Control Valve Upgrade

Control valve upgrade solutions for Wesel steam turbines

GE offers valve improvements exploiting latest technology. These can be installed during a standard outage.

Reliability Improvement

Live steam control valves are key components for the operation of steam turbines. In addition to safe operation, they must operate reliably and with precision, reducing the risk of leakage losses, wearing and unplanned outages.

GE has developed several improvements for Siemens Wesel steam turbine valves. By means of internal parts modifications and technology improvements, the most typical issues affecting control valves are significantly mitigated, reducing both maintenance costs and risks of unplanned shutdown.

Background

The Siemens Wesel control valve blocks (Fig. 1) often face the following issues:

- Steam leakage at valve stems sealing, abrasion and fretting of valve stems, guide bushing and seal rings
- Broken or deformed valve cones and valve stems, fretting between the lifting bar and valve stem and deformation of the disk spring assembly

The servo cylinder actuates the control valve via the lever and valve stems. If leverage points are unfavourable, the valve sealing elements (bushings and carbon rings) experience an abnormal load that may cause the above mentioned issues.

Specific focus is required on valve internals and in respect to wear degradation. This is the result of vibration, outdated technology, thermal gradients and not properly aligned leverage points.

Solutions

With a wealth of many years of experience, GE is able to offer upgrade solutions carried out within the time frame of a major overhaul of the steam turbine.

Upgrade Solutions to Mitigate Steam Leakage

1. Coupling upgrade (Fig. 2)
2. Packing upgrade (Fig. 3)

![Fig. 1: Simplified scheme of a control valve block](image1)
![Fig. 2: Coupling upgrade assembly](image2)
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All the upgrade solutions extend the lifetime of the valve by improving the mechanical integrity of its components. Customers can benefit from modernized components with improved high cycle fatigue resistance and mitigated local load thus high reliability and reduced wearing.

1. The valve plug upgrade solution (Fig. 4) features:
   - Integrated valve cone and valve stem
   - Nut bolted on the stem and secured via a vertical locking pin

2. The lifting bar upgrade solution (Fig. 5) features:
   - Machining of a longer stem cavity to allow the usage of a stem with longer T-root that reduces the contact pressure between the components
   - Machining of the cone stem cavities to allow the usage of sleeves
   - Definition of a proper radial clearances between the stem and the lifting bar to allow the latter to freely expand without loading the stem
   - Definition of a proper axial clearance between the lifting bar and the stem collar to allow free lateral sliding of the lifting bar with respect to the stem

Upgrade Solutions to Mitigate Wearing of Internals

1. Valve plug upgrade
2. Lifting bar upgrade
3. Stem upgrade
4. Component coating

Upgrade solution 1 (coupling) is developed to reduce lateral forces applied to the lever by installing an external guide with a new sliding coupling. This latter takes the lateral forces from the lever which otherwise would load the stem. The result is less fretting in the area of the upper guide bushing and sensible reduction of abnormal loading of the carbon rings. As a consequence, steam leakage at the sealing will be significantly mitigated.

Upgrade solution 2 features the modernization of the packing. An increased number of graphite rings can be applied with shorter distance bushings (Fig. 3) installed. This further help reduce the steam leakage.

Fig. 3: Packing upgrade

Fig. 4: Original (left) and upgraded (right) valve cone and stem

Fig. 5: Original (left) and upgraded (right) lifting bar cavities
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3. The stem upgrade solution (see Fig.6) features:
   • Replacement of the nut, distance sleeve and, if existing, disc spring with an integrated collar with proper axial clearances between the lifting bar and the collar
   • Reinforcement of the stem area close to the collar to improve its mechanical integrity
   • Extended T-root to reduce the contact pressure between the components

4. The upgrade solution 4 is offered to mitigate wearing by implementing the previously described modernizations with appropriate coatings.
   
   Depending on the operating temperature, function of the surface to be coated and technological limitations of each coating process, the customer can benefit from nitration, chrome carbide or Stellite coating on the contact surfaces of the internal parts (Fig. 7).

   In case of excessive wearing on the contact areas between the valve cones and seats (Fig. 8), Stellite can be applied around the seat contact surface. This modification requires a new seat to be installed.

Benefits

• Increased reliability and availability
   Compared to the simple repair or in-kind replacement of internal components, GE’s upgrade solutions provide long lasting improvements in reliability and operability. These factors may lead to better overall plant efficiency and flexibility.

   In addition, the operator can address the typical issues of control valves reducing leakage losses and gaining in control, precision and wearing mitigation.

• Reduced maintenance cost
   This is related to the mitigated risk of unplanned shut down which may result in significant cost saving.

• Lifetime extension
Applicability

These upgrade solutions are specifically developed for SST 600 Wesel units based on Wesel building block configuration.

The above described solutions to mitigate steam leakage are fully applicable to the valve Type 1, shown in Fig. 1 and schematically represented in the table hereafter. Different valve architectures are also shown in that table addressing tailored upgrade solutions capable to mitigate both steam and oil leakage.

The upgrade for Type 2 & 3 features the following:
- Replacement of the existing actuator (1) with a modern electro-hydrostatic actuator, (separate fact sheet available)
- Removal of the recovery spring (2)
- Packing upgrade (3)

Reference

GE has already delivered a number of upgraded control valve for chemical and Pulp&Paper plants in Italy, UK and Netherlands.